MTH 120 Names: _____
Elementary Statistics April 8, 2015
Professor Chester Ismay

Sections 8.1 and 8.2 Written Questions

All of the questions on this handout are based on the following scenario.
Xylitol is a food sweetener that may also have antibacterial properties. A Finland study was designed to test if chewing gum containing xylitol could reduce the risk of middle ear infections in children in daycare centers. The researchers divided a representative group of 533 daycare children into three groups. Group 1 regularly chewed gum containing xylitol, group 2 took xylitol lozenges, and group 3 regularly chewed gum without xylitol. Subjects were followed for three months and for each child the researchers recorded whether or not the child had an ear infection.The results are shown in the table below.

Ear Inf?	Lozenge	Xylitol Gum	Placebo	Total
Yes	39 (22.2%)	29 (16.2%)	49 (27.6%)	117 (22%)
No	137 (77.8%)	150 (83.8%)	129 (72.5%)	416 (78%)
Total	176	179	178	533

The chi-squared contribution for the xylitol lozenge group can be calculated "all at once" (as opposed to finding the contributions for both the "Yes" cell and "No" cell separately, and adding these two values together) by squaring the standardized value of $\widehat{p}_{lozenge}$, relative to $\widehat{p}_{ear\ infection}$ (the overall sample proportion of ear infections), that is

$$\begin{aligned}
\chi^2_{lozenge} &= \left(\frac{\widehat{p}_{lozenge} - \widehat{p}_{ear\ infection}}{\sqrt{\widehat{p}_{ear\ infection}\left(1 - \widehat{p}_{ear\ infection}\right)/n_{lozenge}}} \right)^2 \\
&= \frac{\left(\widehat{p}_{lozenge} - \widehat{p}_{ear\ infection}\right)^2}{\frac{\widehat{p}_{ear\ infection}\left(1-\widehat{p}_{ear\ infection}\right)}{n_{lozenge}}} \\
&= \frac{n_{lozenge}\left(\widehat{p}_{lozenge} - \widehat{p}_{ear\ infection}\right)^2}{\widehat{p}_{ear\ infection}\left(1 - \widehat{p}_{ear\ infection}\right)}
\end{aligned}$$

Give the numeric values of each quantity below, and then calculate the chi-squared contribution for the xylitol lozenge group, showing your work.

1. $\widehat{p}_{lozenge} =$

2. $\widehat{p}_{ear\ infection} =$

3. $n_{lozenge} =$

4. $\chi^2_{lozenge} =$